

## NEW STUDIES OF THE ARRHENURI

BY RUTH MARSHALL

Since the publication of "The Arrhenuri of the United States," in 1908, the author has been fortunate enough to secure enough more material to justify the publication of a supplementary paper on this large genus of water-mites. This material consists of collections from new localities in the United States, and of additional material from old collecting grounds, together with a few specimens from other countries. The author's own collections were made in Wisconsin and Illinois. A few new places were visited, as the lakes about Milwaukee; and more extensive collections were made in previously known bodies of water, as Lake Wingra, Mirror Lake, Lake Spooner, Wisconsin, and the Illinois River at Havana. As a result, several hundred more Arrhenuri have been studied, representing twenty-eight species; the habitats of eleven species have been extended beyond state lines, and three new species have been added to the genus, while four more females have been identified.

Through the courtesy of Dr. E. A. Birge and Mr. Chauncey Juday, the author was allowed to look over the collections at the University of Wisconsin, including some material from the United States Fish Commission, as well as private collections. The author is also indebted to Miss E. J. Rigdon and to Mr. H. S. Pratt (through Dr. R. H. Wolcott) for other water-mites. The species will be taken up in the sequence established in the former paper.

### *Arrhenurus rotundus* Mar.

Pl. I, fig. 8

1908. *A. rotundus* Marshall. Trans. Am. Mic. Soc., XXVIII: 89-90, pl. VII, figs. 1-4; pl. IX, fig. 128.

One individual of this small and rare Arrhenurus was found in a small pool between Madison and Lake Waubesa, Wisconsin, June 24, 1909. It had been found in but two other localities, both in Wisconsin.

### *Arrhenurus setiger* Koen.

1895. *A. setiger* Koenike. Abh. Ver. Bremen, XIII: 178, pl. 1, figs. 11-13.

1901. *A. setiger* Piersig. Das Tierreich: 113-114.

Much interest attaches to the finding of this species, which was known before only from material collected in Alberta. One individual was found with *A. rotundus*, which it resembles, in a pool near Madison, Wisconsin, June 24, 1909. In structure and size it was found to agree with Dr. Koenike's description; in color, however, it was not yellow green, but deep red.

*Arrhenurus bicaudatus* Mar.

1908. *A. bicaudatus* Marshall. Trans. Am. Mic. Soc., XXVIII: 91, pl. VII, figs. 8-10.

This mite was found for the first time in Wisconsin at Neshota, September 26, 1908; and later was found in Mirror Lake, Delton, August 17, 1910. Only one individual was secured in each place.

*Arrhenurus infundibularis* Mar.

1908. *A. infundibularis* Marshall. Trans. Am. Mic. Soc., XXVIII: 93-94, pl. VIII, fig. 20; pl. IX, figs. 21, 22.

Three individuals were found in early summer in two collections from Lake Wingra, at Madison, Wisconsin, the first time for this locality.

*Arrhenurus lyriger* Mar.

1908. *A. lyriger* Marshall. Trans. Am. Mic. Soc., XXVIII: 94-95, pl. IX, fig. 26; pl. X, figs. 27, 28.

This unusual mite was found in single individuals in three different collections from Mirror Lake, Delton, Wisconsin, the first specimens from this place.

*Arrhenurus scapulatus* n. sp.

Pl. I, figs. 2-6

This interesting new species has an unusual form which places it midway between the subgenus *Micrurus* and the subgenus *Megalurus*. The oval body has pronounced elevations over the eyes, and a small, completely closed dorsal shield. At the point where the body and the appendix join are two large, outstanding humps. The appendix, short and narrow, but distinctly marked off from the body,

seems at first to relate the mite to the "long-tailed" Arrhenuri. But the dorsal surface of the end is depressed, and in it lies a tiny bladder-like structure (P, fig. 3), which seems to represent the petiole. The fourth leg lacks the spur on the fourth segment. These characters place the species in the subgenus *Micrurus*. The fourth pair of epimera have indistinct posterior borders. The palpi have a group of several blunt, blade-like bristles on the inner side of the second joint, a character which has suggested the specific name. Outside of this bunch is found a larger group of slimmer, pointed hairs. The color in the preserved specimen is deep blue. The length of the body is 1.1 mm; the width, 0.8 mm.

Only one individual of this species is known. This was found in the Richard collection, at the University of Wisconsin, taken at Mayumba, in the Congo, Africa, June 20, 1890. Its nearest known relative appears to be *A. pectinatus* Koenike, another African species, which was found in Zanzibar and Madagascar. *A. scapulatus* has a longer appendix; but in the form of the body, the position of the humps, the closed dorsal area, and the blades on the palpi, the two species show their relationship.

*Arrhenurus laticaudatus* Mar.

1908. *A. laticaudatus* Marshall. Trans. Am. Mic. Soc., XXVIII: 95-96, pl. IX, figs. 23-25.

One specimen of this rare Arrhenurus was found with *A. lyriger* in Mirror Lake, Delton, Wisconsin, Aug. 27, 1910, for the first time.

*Arrhenurus birgei* Mar.

1903. *A. birgei* Marshall. Trans. Wis. Acad., XIV: 158-159, pls. 16, 17, fig. 10.

1908. *A. birgei* Marshall. Trans. Am. Mic. Soc., XXVIII: 97-98.

This widely distributed mite was found in three new localities in eastern Wisconsin—Mukwanago, Neshota and Pewaukee lakes—in the fall of 1908. It was also found again in Mirror Lake, Delton, Wisconsin; and in collections made by Dr. E. A. Birge at New Orleans and Slidell, Louisiana. In all, twenty-five individuals were obtained.

*Arrhenurus solifer* Mar.

1908. *A. solifer* Marshall. Trans. Am. Mic. Soc., XXVIII: 99-100, pl. XI, figs. 36-38.

One more specimen of this rare species has been found; it was collected by Mr. H. S. Pratt at Cold Springs Harbor, Long Island, New York. It was known before only from New Hampshire.

*Arrhenurus scutuliformis* Mar.

1908. *A. scutuliformis* Marshall. Trans. Am. Mic. Soc., XXVIII: 100, pl. XI, figs. 39-42.

This is another rare *Arrhenurus* whose range is now extended. It had been known only in collections from two localities in Michigan. One more individual was found September 3, 1907, in Bass Lake, near Spooner, Wisconsin.

*Arrhenurus pseudocylindratus* Piers.

1903. *A. cylindratus* Marshall. Trans. Wis. Acad., XIV: 156-157, pl. 17, fig. 8.

1904. *A. pseudocylindratus* Piersig. Zool. Cent., XI: 210.

1908. *A. pseudocylindratus* Marshall. Trans. Am. Mic. Soc., XXVIII: 101, pl. XVI, fig. 80.

This large mite occurs again in two collections from Mirror Lake, Delton, Wisconsin, in late August, 1910. While never found in large numbers, it appears to be widely distributed in the United States.

*Arrhenurus tahoci* n. sp.

Pl. I, fig 7; pl. II, figs. 11-14; pl. III, fig. 31.

This new species of the subgenus *Megalurus* has a large oval body and a relatively short and simple appendix. The body is regular in outline, with a large oval dorsal area, the ends of the furrow running over onto the appendix. Within the dorsal area is a large unpaired conical hump, an unusual feature in the "long-tailed" *Arrhenuri*. The appendix is broad at the base, and is not sharply marked off from the body. It narrows in the center, and flares out at the end in well pronounced side corners, on each of which is a small hump. A short distance in front of these is a pair of smaller humps. The genital wings are rather small, but well defined. The

fourth epimera are only slightly wider than the third. Palpi and legs have no especially distinctive characters. The color in the preserved material is greenish yellow. The length of the body is 1.28 mm; the width, 0.82 mm.

Only a single male of this new species is known. This is especially interesting, however, as it was found in a collection from Lake Tahoe, California, made by Mr. Chauncey Juday, on June 29, 1904. The nearest related species appears to be *A. capillatus* Mar., which has been found in but one locality, a pool near San Francisco. The two males are somewhat alike in the form of the end of the appendix; but this is much more sharply marked off in *A. capillatus*.

One other *Arrhenurus* was found with *A. tahoei*. This was a female, which in size and form suggested the same species. An examination of the palpi showed a close similarity of structure, and this may be taken as proof of its identity. A dorsal view is given of this specimen. The length is 1.45 mm; the width, 1.23 mm.

*Arrhenurus manubriator* Mar.

1903. *A. manubriator* Marshall. Trans. Wis. Acad., XIV: 151-152, pls. 15-17, fig. 3.

1908. *A. manubriator* Marshall. Trans. Am. Mic. Soc., XXVIII: 102-103, pl. XII, figs. 46, 47.

The range of this species has been extended to Ohio, where it was collected by the United States Fish Commission at Put-in-Bay, July, 1899, forty-six females, but only one male, being found. It was also found in Lake Neshota and Lake Pewaukee, near Milwaukee, September, 1907, and found again in one collection from Lake Spooner, Wisconsin, July 16, 1909, in each case in but a single specimen of each sex.

*Arrhenurus marshalli* Piers.

1903. *A. globator* Marshall. Trans. Wis. Acad., XIV: 148-150, pl. 14, fig. 1.

1904. *A. marshalli* Piersig. Zool. Cent., XI: 210.

1908. *A. marshalli* Marshall. Trans. Am. Mic. Soc., XXVIII: 103-104, pl. XII, figs. 48, 49.

This species continues to lead all others in number of individuals; nearly four hundred were found in these collections, and they came from seventeen localities. It is also the most widely distributed

*Arrhenurus*. It has been found in fifteen states and Canada—the latter together with Ohio, Arkansas, Texas and Pennsylvania being now added to the list. Material from the United States Fish Commission gave collections from Long Point, Canada; from Bass Island, Ohio; and from Erie, Pennsylvania (1899). Collections made by Dr. E. A. Birge (1903) yielded material from San Marcos, Texas; from Bantig, Arkansas; and from New Orleans and Shreveport, Louisiana. This was the first material received from the first two named states. Two females were found by Mr. H. S. Pratt at Cold Springs Harbor, Long Island, New York, October 8, 1907. The author's own collections have extended the range of the species to eastern Wisconsin, where it was found in Lake Neshota and Lake Pewaukee, September, 1908. It was also found again in collections from Lake Spooner, Mirror Lake (Delton), and the Madison lakes. It appeared in numerous collections from the Illinois River at Havana, during June and July, 1910. New collections were made in pools at Hennepin, Illinois, August 4, 1910; here the enormous number of one hundred and twelve were secured.

*Arrhenurus megalurus* Mar.

Pl. II, figs. 15-17.

1903. *A. megalurus* Marshall. Trans. Wis. Acad., XIV: 150-151, pls. 14, 15, fig. 2.

1908. *A. megalurus* Marshall. Trans. Am. Mic. Soc., XXVIII: 105-106, figs. 50-52.

Next to *A. marshalli*, this species now leads in numbers and in wide distribution. About two hundred new individuals are here represented. New York is added to its range, as thirteen individuals were found at Cold Springs Harbor, Long Island, October 8, 1907, by Mr. H. S. Pratt. Twenty-two were found in collections from Slidell, Louisiana, by Dr. E. A. Birge, June, 1904, a new locality for this state. In the author's collecting in Wisconsin, it was found in one new locality, Lake Pewaukee (1908); and found again in Mirror Lake (Delton), and in Lake Spooner.

*A. megalurus* has always been found to be a variable form, in strong contrast to nearly all other species of the genus. The degree of development of the humps of the body in both sexes, and the amount of indentation of the end of the appendix in the male are

variable characters. The individuals from Slidell all showed the most extreme development of body humps yet found in the species, both sexes taking on a very bizarre appearance (figs. 15, 17). Moreover, some of these individuals were young ones. In strong contrast to these were two females found in a collection from Lake Wingra, Madison, Wisconsin, May 28, 1909, which showed scarcely a trace of the humps, although the normal number of hairs was present (fig. 16). Judging from the crust of the body, they were rather young; but they were mature, for they were found in copula with males.

*Arrhenurus parallelatus* Mar.

1903. *A. parallelatus* Marshall. Trans. Wis. Acad., XIV: 154-155, pls. 16, 17, fig. 6.

1908. *A. parallelatus* Marshall. Trans. Am. Mic. Soc., XXVIII: 107.

Three new individuals of this species were found again in a single collection from Lake Spooner, Wisconsin, August 30, 1907.

*Arrhenurus expansus* Mar.

1908. *A. expansus* Marshall. Trans. Am. Mic. Soc., XXVIII: 107-108, pl. XIII, figs. 53-55.

This species has been found only in Louisiana. One individual was found in a new locality, Schrievessport, by Dr. E. A. Birge, in November, 1903.

*Arrhenurus pseudocaudatus* Piers.

1904. *A. caudatus* Marshall. Trans. Wis. Acad., XIV: 521-523, pl. 40, fig. 1.

1905. *A. pseudocaudatus* Piersig. Zool. Cent., XII: 185.

1908. *A. pseudocaudatus* Marshall. Trans. Am. Mic. Soc., XXVIII: 108.

The single individual from which this species was described was lost. It is a matter of some interest, therefore, to record that another specimen was found, after much search, in the original collecting ground, the inlet of Lake Spooner (Wisconsin), July 16, 1909. It is noticeable for its color, orange red and deep blue green replacing the dull green usually found in the individuals of this sub-genus.

*Arrhenurus semicircularis* Piers.

1903. *A. securiformis* Marshall. Trans. Wis. Acad., XIV: 152-153, pl. 18, fig. 4.

1904. *A. semicircularis* Piersig. Zool. Cent., XI: 210.

1908. *A. semicircularis* Marshall. Trans. Am. Mic. Soc., XXVIII: 111, pl. XVII, fig. 64; pl. XVII, fig. 129.

One more individual of this species was found, May 21, 1909. This was in a new locality, Lake Wingra, Madison, Wisconsin.

*Arrhenurus apetiolata* Piers.

Pl. II, figs. 18-20.

1903. *A. corniger* Marshall. Trans. Wis. Acad., XIV: 155-156, pl. 15, fig. 7.

1904. *A. apetiolata* Piersig. Zool. Cent., XI: 210.

1908. *A. apetiolata* Marshall. Trans. Am. Mic. Soc., XVIII: 113-114, pl. XV, fig. 71.

This species occurs abundantly, over one hundred individuals of the two sexes occurring in eighteen collections, scattered over five states. Its range has been extended to three new states—Pennsylvania, Ohio, and New York. One male occurred in one of the collections made by the United States Fish Commission at Erie, Pennsylvania; and another at Put-in-Bay, Ohio (1899). Three females were found in material collected by Mr. H. S. Pratt, October 8, 1907, at Cold Springs Harbor, Long Island. It was found abundantly in material collected by Dr. E. A. Birge from New Orleans and Slidell, Louisiana (June, 1903; October, 1904). The species was found rather commonly (especially the females) in collections at various points about Havana, Illinois, in July, 1910.

The female previously described (1908) as *Arrhenurus apetiolata* is now known to belong to another species, as yet unidentified. The attention of the author was called to the error by Mr. G. D. Nourse. Since that time the true form has been established. Males of this species have several times been found copulating with females of other species.

The body of the true *A. apetiolata* is elliptical. The anterior border is almost straight; the posterior end is bowed out with prominent side corners. The enclosed dorsal area is large and slightly constricted in the anterior part. The three groups of epimera are



close together; the third pair is broad. The wing-shaped genital areas on either side are large and slant obliquely out and back. The length of the body is 0.75 mm; the greatest width, 0.65 mm. The small size, the elliptical form, the small space between the two posterior pairs of epimera, and the large size and oblique direction of the genital areas are characters which readily distinguish *A. petiolata* from the females of other species.

*Arrhenurus trifolius* Mar.

1908. *A. trifolius* Marshall. Trans. Am. Mic. Soc., XXVIII: 115, pl. XV, figs. 72-74. .

Two individuals were collected in pools at Hennepin, Illinois, and one at Havana, in the summer of 1910, the former a new locality for the species.

*Arrhenurus reflexus* Mar.

1908. *A. reflexus* Marshall. Trans. Am. Mic. Soc., XXVIII: 117-118, pl. XVII, figs. 84-86.

The range of this rare species has been extended to Ohio, where one individual was found in a collection made by the United States Fish Commission, July 18, 1899. One new specimen was also found in a new locality in Wisconsin—Mirror Lake, Delton, August 27, 1910.

*Arrhenurus falcicornis* Mar.

Pl. III, fig. 30.

1908. *A. falcicornis* Marshall. Trans. Am. Mic. Soc., XXVIII: 121-122, pl. XIX, figs. 96-98.

Five individuals of this species were found in the present collections. It is known now for the first time from New York, through the collection at Cold Spring Harbor, Long Island, made by Mr. H. S. Pratt, October 8, 1907. It was found in one new locality in Wisconsin—Lake Mukwanago, October 17, 1908.

*Arrhenurus laticornis* Mar.

Pl. III, figs. 21-24

1908. *A. laticornis* Marshall. Trans. Am. Mic. Soc., XXVIII: 122, pl. XIX, figs. 99-101.

In collections made at Havana, in the Illinois River, in July of 1910, *A. laticornis* was almost always present in considerable numbers, outnumbering the other species, and exceeding the numbers found in any collections of former years. With the exception of this species, the Arrhenuri were not found to be as abundant in this region, either in species or individuals, as they were before the opening of the Chicago Drainage Canal, judging by the comparison of the 1910 collections with those made in earlier years by the Illinois State Biological Station. In August of the same year, the author found this species also occurring, in smaller numbers, in nearly all of the collections made at Mirror Lake, Delton, Wisconsin. It had been found but once before in this body of water. These were the only two localities where this species has been found since the species has been established.

*A. laticornis* fem. is now known; it occurred in almost equal numbers with the male in the present collections. The body is narrow in the region of the eyes, broad and truncated at the posterior end. The palpi (like those of the male, but larger) are stout, and characterized by the great length of the saber-like bristle near the end of the claw. The second segment has four bristles on the inner face.

*Arrhenurus pollictus* n. sp.

Pl. I, figs. 9, 10; pl. III, figs. 25-28.

This new and rare species belongs with the most highly differentiated Arrhenuri, the subgenus *Arrhenurus*; within this subgenus it is found in a small but well defined group, characterized by the presence of a pair of sickle-shaped humps placed dorsally near the base of the appendix. It resembles the European species *A. compactus* Piers., and the American species *A. falcicornis* Mar., from both of which it is at once distinguished by the form of the petiole, as well as by its smaller size. The body is oval, the enclosed dorsal area moderately elevated, its furrow running out to lose itself on the lateral projections of the appendix. The genital area is narrow and long, with an indistinct anterior border. It forms conspicuous rolls on the sides of the body. The epimera have the usual form; the first pair have sharp anterior points, and the fourth are moderately wide and placed close together. The appendix is short and

broad with strongly developed posterior angles. On the median dorsal surface the two small humps are unusually large (fig. 25, H), as are also the pair on the ventral side (G). The petiole, which is always so characteristic a feature of these Arrhenuri, has a heavy dorsally curved central piece (A); around it is wrapped a thinner piece (B), open on the dorsal side. From the latter extend little bladder-like pieces (D). The hyaline appendage (Hy) is small and very narrow on the posterior border. The number and position of the hairs on the appendix is typical of the group.

The fourth leg is short and stout in the first four segments. The fourth segment, the longest, as usual, has its process uncommonly well developed, the end being bent back, like a thumb. The swimming hairs and bristles of this appendage are quite typical. The palpi are stout, and present no striking characteristics, unless it be the rather large number of bristles on the inner side of the second joint.

The entire length of the body of this mite is 0.78 mm; the width, 0.58 mm. The color is the usual blue green. Only one male is known, a young but fully formed one. This was found in a small pool near Kilbourn, Wisconsin, August 7, 1907. The pool fluctuates considerably in size, and has yielded very few Arrhenuri. A female found at the same time and agreeing with the male in the structure of the palpi, was identified as belonging also to this species.

*Arrhenurus magnicaudatus* Mar.

1908. *A. magnicaudatus* Marshall. Trans. Am. Mic. Soc., XXVIII: 123-124, pl. XX, figs. 106-8.

One individual of this large species was found in the present collections, from a new locality. It was taken from Mirror Lake (Delton), Wisconsin, August 27, 1910.

*Arrhenurus americanus* Mar.

Pl. III, fig. 29.

1908. *A. americanus* Marshall. Trans. Am. Mic. Soc., XXVIII: 126-127, pl. XXI, figs. 112-117.

*Arrhenurus americanus*, one of the commonest of the American species, was found in a large number of the collections. Collections of the United States Fish Commission, July and August, 1899, have

extended its range to Canada (Long Point), and to Ohio (Put-in-Bay). It was found again at Madison, Wisconsin, by Miss E. J. Rigdon, June, 1909. It was collected in two new localities in eastern Wisconsin—Lake Neshota and Lake Pewaukee—in the fall of 1908. It was found again in large numbers in Lake Spooner, Wisconsin, in 1907 and 1909; and in smaller numbers at Havana, Illinois. It did not appear, however, in the numerous collections made in Mirror Lake, Delton, Wisconsin, in August, 1910, although it had been found in less extensive collections in three former years.

*Arrhenurus americanus* var. *major* Mar.

Pl. I, fig. 1

1908. *A. major* Marshall. Trans. Am. Mic. Soc., XXVIII: 128-129, pl. XXI, figs. 118-120; pl. XXII, fig. 121.

Although never found in large numbers, the range of this variety is as great as that of *A. americanus*. It was found again in Lake Spooner and in two other new localities in Wisconsin: Lake Mukwanago (1908), and Mirror Lake, Delton (1909).

Rockford, Ill., Nov. 1, 1910.



